CITY OF OTTAWA

COMMUNITY DEVELOPMENT DEPARTMENT

ENERGY PLANNING

PLANNING MEASURES
TO SAFEGUARD SOLAR ACCESS FOR BUILDINGS
IN OTTAWA

DISCUSSION PAPER CD-164-6

MARCH 1981

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PLANNING MEASURES TO SAFEGUARD SOLAR ACCESS FOR BUILDINGS IN OTTAWA

Summary of Discussion Paper CD-164-6

The City's draft Energy Conservation Policy, now awaiting Council approval, consists of the following goals:-

1. Increase the awareness and promote the co-operation of the public in energy conservation;
2. Amend the Official Plan and promote energy-efficient planning;
3. Increase the efficiency of transportation and reduce its dependence on non-renewable energy sources;
4. Extend and publicize conservation in the public sector, to set an example for the private sector.

The protection of solar access for buildings in order to allow their owners to utilize the energy reaching us continually from the sun, is an aspect of Goal 2 and the objective of this study is to explore the options available, to establish a simple way of regulating such access and investigate some likely impacts of solar access regulations. The underlying assumption is that the largest possible number of energy consumers should have the opportunity of utilizing the abundant energy of the sun, because with nearly 2000 hours of sunshine per year, Ottawa is more fortunate than Windsor and Vancouver in this respect.

The case in favour of solar access protection rests first and foremost on the considerable savings likely to accrue to householders in retrofitting an existing home in the Glebe, Ottawa South or Westboro - the areas on which the study is focussed for solar access applications. Over a five-year period, the installation and running costs of a solar heating system show a saving of some $4,200 over equivalent costs for an oil system. Solar access protection would encourage a householder to invest in this type of retrofitting without fear that his expensive solar collectors would be continuously under the threat of being overshaded by a new structure or some vegetation growing in their vicinity. In accordance with the location of collectors, there are four levels of solar access protection, as follows:-

i) ROOFTOP SOLAR ACCESS PROTECTION: The simplest and least controversial, because in a residential area of say, 2-storey houses the possibility of conflict between adjacent homes obscuring each other's rooftop solar collectors is minimal.

ii) SOUTH WALL SOLAR ACCESS PROTECTION: This may necessitate lower residential densities, or specially designed roof and house shapes to protect the solar access space available to a neighbouring house.

iii) SOLAR ACCESS PROTECTION FOR PARTS OF A LOT allows the installation of solar collectors at ground level. This is obviously a more stringent requirement as the safeguarding of access space all the way to the ground surrounding a neighbour's house, necessitates a large lot, a distant position and perhaps even a special roof or building shape for a house. All these requirements obviously spell more dollars and cents.

iv) SOLAR ACCESS PROTECTION FOR ACCESSORY BUILDINGS allows the installation of solar collectors on garages and other outbuildings. This may appear to be less critical until one considers greenhouses, which may become an important source of fresh food for a household in the future, as food becomes increasingly more expensive.

Each of these may suit a different area of the City in accordance with 8 factors enumerated in the study - (i) and (ii) above for example, appear to be suitable for most of the Glebe; (i), (ii) and (iii) for most of Ottawa South; but for Westboro the choice is less clear. An important factor in the choice of protection level is likely to be the reaction of citizens. The case in favour of protection is concluded with the enumeration of potential indirect benefits of solar access protection: Employment growth and diversification, encouragement to innovative designers, more variety in the urban scene, etc. The simplest method of legally establishing the 'right to light' is considered to be SOLAR ACCESS ZONING to overlay existing land use zones in the city with some new requirements affecting building height, bulk, location, landscaping, etc.

The case against solar access protection consists of social, political, economic, environmental and legal arguments. 'Blanket' zoning may not be considered fair, for example, because certain locations are more advantageous than others and this may give rise to disputes among neighbours. Politically, solar access protection may compound and perpetuate existing inequities in land ownership and be used as an instrument for extracting more taxes. Restrictions in development imposed by solar access zoning will certainly affect employment prospects in the building industry and the effect on the urban environment and vegetation may be quite profound:- incongruent shapes and surfaces, vandalized solar collectors, lopped trees and dwarf bushes, etc. As a legal means of ensuring solar access, zoning may be simple, but in its day-to-day application, it could well give rise to disputes and delays and thus procastinate the development control process.

The controversy as to whether solar access for buildings should be legally protected, may be resolved only through public debate and no preference is therefore indicated in the study. It is proposed to discuss the pros and cons and the suitability of various levels in solar access at a series of public meetings in the Glebe, Ottawa South, Westboro and elsewhere, in order to increase public awareness and gauge community feeling on the matter. Comments and summaries of the discussions held in these communities will subsequently be submitted to the Council, together with any recommendations for future action.

A. SUBJECT

PLANNING MEASURES

TO SAFEGUARD SOLAR ACCESS FOR BUILDINGS

IN OTTAWA

Discussion Paper CD-164-6

B. BACKGROUND

1.0 Reasons for the study

The continual rise in the cost of energy, coupled with the urgent need for a transition in our reliance from non-renewable fossil fuels to renewable energy sources, make it imperative for the Council, as the tier of government most closely related with the collective needs of people at local level, to consider measures for the conservation of energy and for the utilization of energy sources available in the region. The Council's Energy Conservation Policy consists of the following goals:

1. Increase the awareness and promote the co-operation of the public in energy conservation;
2. Amend the Official Plan and promote energy-efficient planning;
3. Increase the efficiency of transportation and reduce its dependence on non-renewable energy sources;
4. Extend and publicize conservation in the public sector, to set an example for the private sector.

One aspect to be dealt with under Goal 2 above is the question of solar access for buildings. The low, but continuous radiation of energy from the sun is one of the most abundant alternative sources to oil and with the growth of solar technology, it could satisfy some of our needs, particularly in space and water heating. The means available for the exploitation of solar energy tend to be rather expensive at present, but it is expected that further innovation, mass production and competition between solar product manufacturers, will soon bring this technology within reach of most households in Canada. In the meantime, we should perhaps consider the question as to whether solar access should be safeguarded for every household and what problems arise in such protection being created as an extension of legal rights. Other aspects include the social impact it may have in terms of relations between neighbours and the economic impact on construction activity and employment in a region.

The objective of this study is first to explore ways and means of ensuring access to solar energy for every building, secondly to establish the least complicated way of regulating such access and finally to gain an understanding of the possible social and economic impact of problems related to solar access. At this preliminary stage, it is meant to stimulate discussion on the opportunities and responsibilities implicit in solar access protection, rather than make any recommendations to the Council.

The origins of this study may be traced back to January 1980, when elected City Hall officials and staff attended the CITIES' ENERGY CONFERENCE in Toronto. Following this conference, a number of Community Development issues were identified in Report No. 0833-079/80, dated February 8, 1980 and addressed to the Planning Board. The need to protect solar access was one of the issues identified in that report and the same need was mentioned in the Development Plans for Westboro and Ottawa South. These two areas together with Glebe will be referred to in this study to illustrate the problems that arise with overshading in various seasons and times during the day and to derive possible solutions and measures for the protection of solar access.

The study as a whole will be used as background material for discussions to be organized at community centres in the above-mentioned three areas and elsewhere in the city, in order to increase public awareness on the subject, ensure a wide involvement of the public in the debate for or against solar access protection, assist technical committees in the formulation of solutions and to obtain wide-ranging comment on any measures for such protection as may be submitted to the Council for approval.

C. RATIONALE

1.0 Why Solar Access

As outlined in the Background , solar energy could be expected to play an increasing role in the satisfaction of our energy needs in the foreseeable future. At present, the only economically viable application of solar technology may be for water heating and passive solar space heating, but all indications are for increasing technological developments in the field, as a natural reaction to the increasing costs of oil and other non-renewable sources of energy.

In order to allow the largest possible number of energy consumers to benefit from the increasingly cost-effective applications of current and foreseeable solar technology, it would be prudent for a municipality to consider measures for the timely protection of solar access to every building in its area. Protection at this early stage in the development of solar technology would be a stimulus for the growth and diversification of its products, for the retrofitting of older homes, for the construction of new 'solar' homes, for the development of novel approaches in architectural design, but above all, for the proliferation of the energy conservation effort to every household and firm requiring built accommodation in an area. On the other hand, however, the prohibition of building above a certain height in relation to surrounding structures, the limitation in shape of building, the ban on trees and the

curtailing of plant growth to safeguard solar access for a neighbouring building, could all have adverse effects on the environment, economic development and social life of an existing city. The remaining parts of this report will therefore be given to a discussion of the pros and cons of solar access protection, in order to stimulate individuals and organizations to develop their own arguments and proceed towards a full consideration of the matter, before a decision is reached and the appropriate safeguards are established.

D. THE CASE IN FAVOUR OF SOLAR ACCESS PROTECTION

1.0 Scope

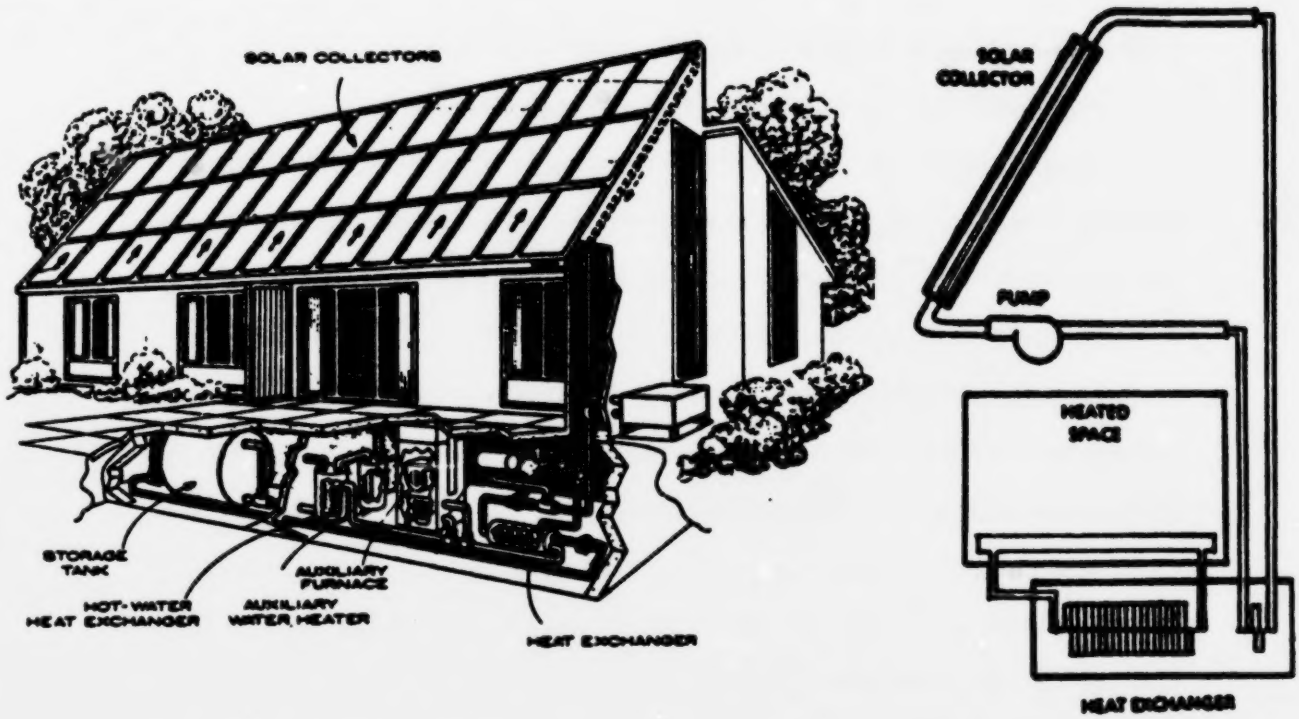
The arguments in favour of safeguarding access of the sun to all buildings in an existing city like Ottawa will progress from the benefits of the sun as a source of energy to the foreseeable economic benefits of growing solar technology. Subsequently a number of options in the extent of solar protection will be developed and the legal means for the implementation of each will be considered. Throughout this discussion, the areas which will be referred to for the application of various concepts will be the neighbourhoods of Glebe, Ottawa South and Westboro.

2.0 The Sun as a Source of Energy: Can we afford to ignore it?

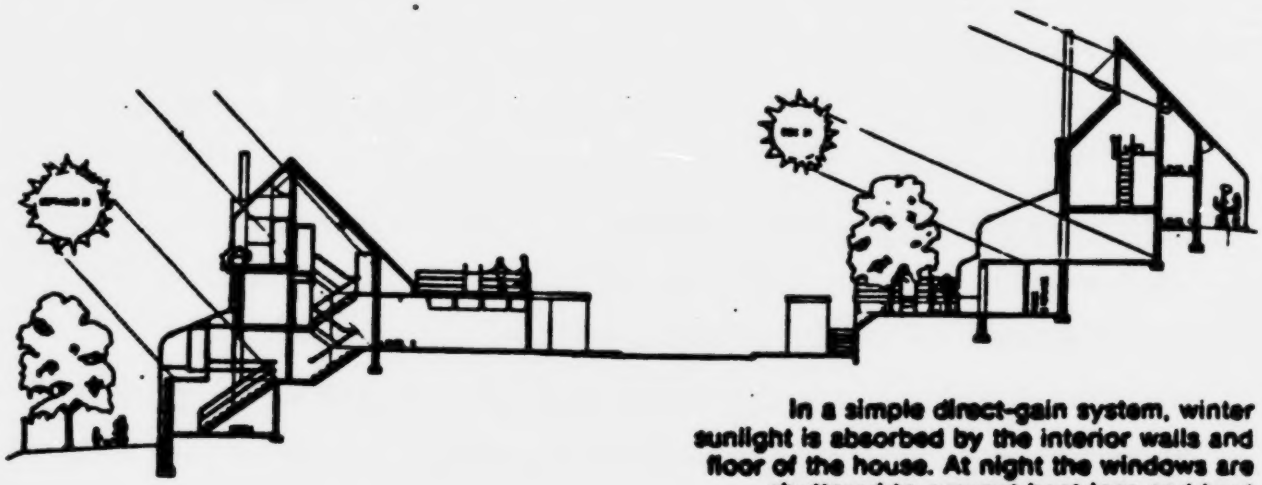
The sun is estimated to be some 8 to 10 billion years old and it is expected to keep burning for at least another 4 billion years. It produces energy in the form of radiated heat, light - and probably sound - at a distance of 90-96 million miles from the earth, by means of continuous thermonuclear fusion at the rate of some 4.7 million tons of matter per second. The energy received on earth is in the form of:

(i) infrared rays which have long wave-lengths and produce heat; and

(ii) in the form of short wave ultraviolet rays which give us light.



ACTIVE SOLAR HEATING SYSTEM



PASSIVE

Architects:
J. Somfay and J. Fryett

In a simple direct-gain system, winter sunlight is absorbed by the interior walls and floor of the house. At night the windows are shuttered to prevent heat loss and heat radiates from the floor, etc., to warm the living space. In summer the windows are kept closed and shaded during the day and are opened at night to allow cool air to circulate. Roof overhangs designed to intercept the high summer sun but not the low winter one, shades and deciduous trees can be used to shade windows.

Fig. 1: ACTIVE AND PASSIVE SOLAR HEATING SYSTEMS

Both infrared and ultraviolet rays release also some electromagnetic radiation which so far only satellites in outer space have been able to use economically. The sun directly influences also all other natural sources of renewable energy - winds, tides, rain and geothermal forces - which we have only just begun to wonder how to use.

After a dissipation of some 73% of solar radiation in the atmosphere, an average of 1400 BTU's of heat are received on every square foot of the surface of the earth. This is equal to what a large hydro-electric plant may produce at the same rate. This heat may be harnessed through ACTIVE or PASSIVE SOLAR HEATING SYSTEMS (Fig. 1) which may be defined as follows:

ACTIVE SOLAR HEATING SYSTEM: A system which collects and transforms solar radiation into usable heat by reliance on mechanical means or a chemical process.

PASSIVE SOLAR HEATING SYSTEM: A system which collects solar radiation through windows and other heat conductor surfaces, in order to store it in the form of heat in massive parts of a structure - e.g. concrete walls, roof and floor slabs etc. - and subsequently release it to surrounding fluids, to heat air or water through convection.

Both these types of solar heating are being continually improved to absorb a larger proportion of the heat received from the sun and minimize heat loss.

The low intensity, but continuous energy of solar radiation is reaching the surface of the earth in more than sufficient quantities to heat a home and provide for its hot water needs during the day. It has in fact been estimated that all current energy needs in North America could easily be met from solar energy falling on only 1% of the total land surface (Hellman, 1973). It is free energy, non-polluting and unlimited - for at least another 4 billion years. The greatest challenge is technological - how to collect, store and use this energy, during the periods of the day or the year when the sun is totally or partially absent.

Although it is possible to concentrate solar rays with sophisticated equipment to derive high intensity energy, the cheaper, low intensity energy collected by passive and most active systems is particularly suitable for space and water heating. Both air and water are fluids and can be heated by conduction, convection and radiation, all of which may be initiated by the sun. By contrast, the high quality, rapid-output energy sources like oil and electricity, rely on one or two of the above-mentioned heat transfer processes at a time and they are more suitable for intense or concentrated energy needs. It would only be common sense therefore, to avoid the use of high intensity energy for low intensity needs - like space and water heating, which could best be met by the sun.

The legal protection of solar access would be the first step in promoting this sensible approach to energy use.

3.0 The Feasibility of Solar Energy Utilization in Ottawa

It may be argued that the severity of our climate leaves little scope for the utilization of solar energy in Ottawa. Our latitude of 45^{o} N and the annual average of 1,995 hours of bright sunshine per annum however, place our city in a more favourable position than Vancouver (1600-1800 hrs) or Windsor (1900) which are in lower latitudes.

A number of experiments undertaken by agencies of the Federal Government, by the City and by private enterprise make the feasibility of solar energy utilization quite evident. The Building Research Division of the National Research Council for example, has undertaken the most extensive studies in Canada on the subject, with its MARK XI RESEARCH PROJECT which compares various energy utilization systems in four comparable residential buildings. Another important demonstration project has been promoted by C.M.H.C. through the installation of solar water heating equipment in LeBreton Flats. All indications and comparisons to date show that "active solar" is a viable proposition in this region, in terms of energy utilization.

The City of Ottawa has also been active the use of solar energy. Two demonstration housing units in Overbrook have been fitted with solar heating equipment and the Department of Physical Environment installed solar pre-heating equipment in the Brantwood Park Fieldhouse as early as 1977. Solar de-icing equipment to prevent ice formation below the arena

slab was installed in the Tom Brown Arena in 1978. All these installations have proved to be cost-effective and certainly more economical than equivalent non-solar systems over the expected life of the buildings in which they have been fitted.

The private sector of the building industry in Ottawa has also produced some noteworthy structures for the exploitation of solar energy. The QUARTET passive solar townhouses built by 'ECODOMUS' at the corner of Wilbrod and Chapel Streets, coupled with the more recent active solar townhouses on Charlotte and Wilbrod Streets have demonstrated not only the feasibility of solar heating in Ottawa, but also the increase in net savings as oil and natural gas prices go up.

In order to encourage private and public enterprise to undertake more and wider-ranging experiments in Ottawa until solar energy becomes a widely-accepted alternative to oil, it is important, at this point in time, to consider safeguards to solar access to buildings in our City. Assuming that as a result of the present study, appropriate measures were enacted to protect such access, then householders and companies would invest more readily in solar heating installations, with the confidence that their investment was not likely to be wasted through overshadowing from a new structure in the vicinity of an installation.

RESULTS OF A 1978 SURVEY ON ENERGY EFFICIENT HOME VALUES (DOW, 1978)

ENERGY IN THE HOME	Builders	Buyers	Sellers
Is an energy-efficient home worth more?	Yes, 9% more at purchase	Yes	Yes, 7% more at re-sale.
Insulation—most important new home feature.	82%	95%	89%
Amount extra buyers would spend for a comprehensive insulation package.	$828	$1360	$934

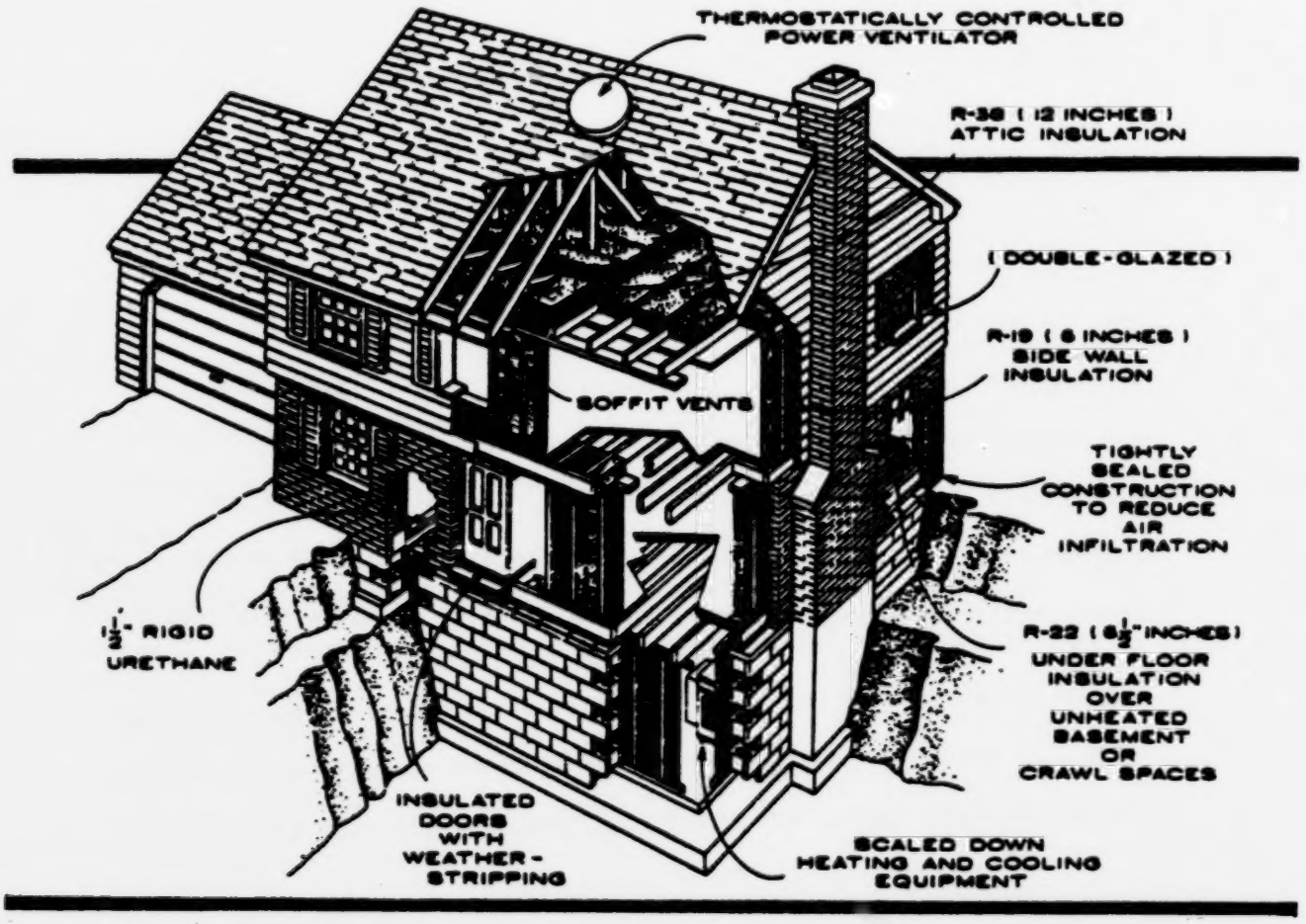

THERMOSTATICALLY CONTROLLED POWER VENTILATOR
R-38 (12 INCHES) ATTIC INSULATION
(DOUBLE-GLAZED)
R-19 (6 INCHES) SIDE WALL INSULATION
SOFFIT VENTS
TIGHTLY SEALED CONSTRUCTION TO REDUCE AIR INFILTRATION
1½" RIGID URETHANE
R-22 (6½" INCHES) UNDER FLOOR INSULATION OVER UNHEATED BASEMENT OR CRAWL SPACES
INSULATED DOORS WITH WEATHER-STRIPPING
SCALED DOWN HEATING AND COOLING EQUIPMENT

Fig. 2: HOUSE STRUCTURE ASSUMED FOR THE COMPARISON OF HEATING SYSTEMS AND ENERGY - EFFICIENCY MEASURES RECOMMENDED PRIOR TO SOLAR HEATING INSTALLATION

4.0 Potential contribution of solar energy to domestic heating in Ottawa

In order to illustrate the potential contribution of an active solar system to residential heating in the City, a comparative analysis of oil and solar heating installations and of corresponding annual running costs was carried out under the following assumptions:

- Two-storey, 3 bedroom house, built around 1940 for a single family (Fig. 2)
- Approximately 152 square metres (1500 sq. ft) of usable floor space; 20 sq. m (196 sq. ft.) of window area; 155 sq. m. (1526 sq. ft.) of net wall area (all conversions approximate);
- Mean annual Heating Degree-Days for Ottawa: 4,670;
  (Note: Heating Degree-Days (HDD) indicates the difference between 18^{0} C and the mean temperature at a location, multiplied by the number of days during the year in which this difference is observed. HDD is therefore an indication of annual heating demand at a location);
- Total absence of overshading by trees or structures in the vicinity of solar collectors;
- Maintenance-free operation of oil and solar heating installation, under 5-year guarantee protection of the consumer.

It is important to emphasize at the outset that retrofitting an older house with higher insulation and thorough winterizing measures is an imperative first step to the installation of solar heating systems. Such measures, including storm windows and double glazing could result in savings of 24.36% in the consumption of oil (CMHC, 1977). By comparison, a newly built house, thoroughly insulated during construction rather than retrofitted with these measures, would consume 60.8% less oil than an old house without the benefit of any upgrading in insulation or winterization. Retrofitting an old house is estimated to cost about 10% of the cost of a solar heating system, as shown in the following figures:

TABLE 1: COMPARISON OF OIL AND SOLAR HEATING INSTALLATION AND RUNNING COST

A. INSTALLATION COSTS

Expenditure item	Oil System	Solar System
Heating system	$ 1,700	$10,000
Retrofitting insulation, etc.	NIL	1,500
Less CHIP grant		-500
TOTAL (A):	$ 1,700	$11,000

B. 1981 RUNNING COSTS (PER ANNUM)

-Fuel	$ 2,016.64	NIL
(2062 gallons @ 97.8¢/gal. Feb. 1981 price)		
-Back-up electric heating	NIL	$17.00
on cloudy days		
(500 KWh; first 250 kw @ 3.68 ¢/KWh)		
TOTAL (B) - (1981)	$ 2,016.64	$17.00

Assuming a 15% increase in the cost of oil and 12% projected increase in the cost of electricity per annum, by 1986 the totals would be as follows:

TOTAL (B) - (1986)	$13,596.96	$108.00

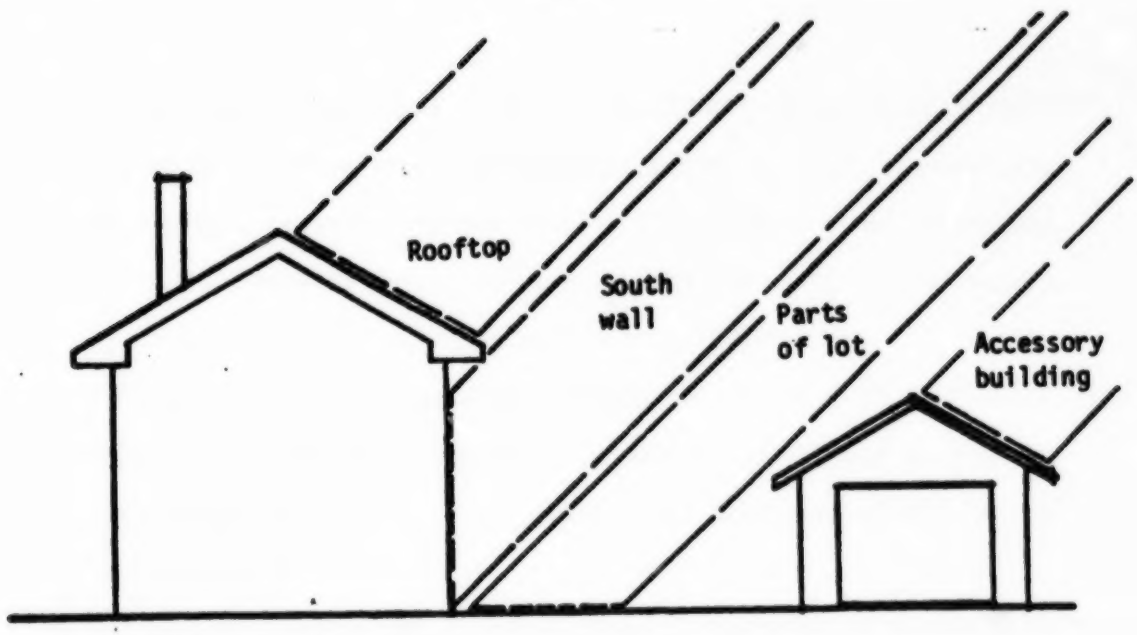
The Grand Total expenditure for these two systems in terms of Installation and Running Costs over the five (5) year period 1981 to 1986 would be as follows:

GRAND TOTAL (1981-1986)	$15,296.96	$11,108.00
(Difference:	+ $ 4,188.96	less $ 4,188.96)

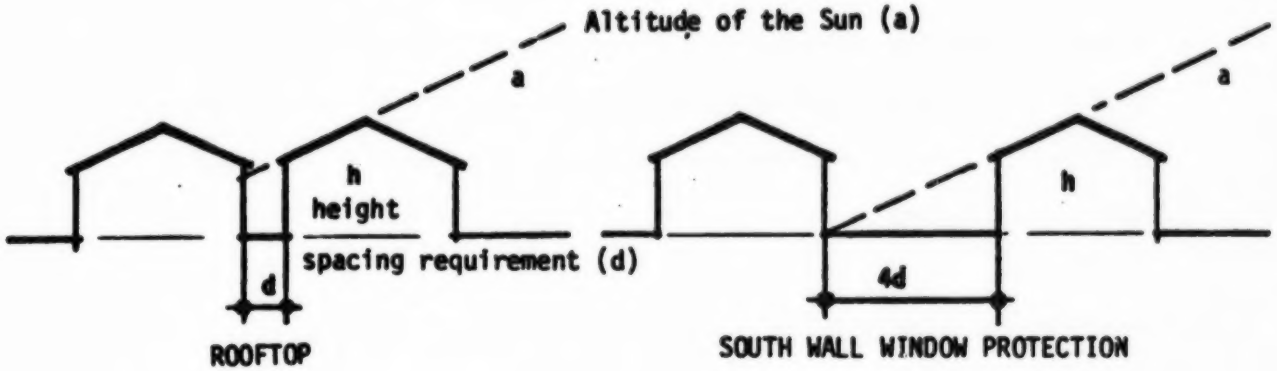
The comparison underlines the importance of the long term view in heating energy audits and proves amply the viability of solar heating. Unfortunately the high mobility of the population in Canada (26% of all Canadians change their residential address every year) makes this long term view difficult to take and the front-end costs of a solar system tend to look rather discouraging. A recent survey of opinion among house builders, buyers and sellers (Fig. 2) indicates that people are prepared to pay between 7% to 9% more for an energy-efficient home.

5.0 Options in Solar Access Protection

The most important assumption underlying the foregoing illustration of the viability of solar heating in Ottawa concerned the total absence of overshading by trees or structures in the vicinity of solar collectors. This absence ensures complete SOLAR ACCESS PROTECTION which has been defined as "a legally enforceable right to a reasonable proportion of the natural, unobstructed flow of direct solar radiation, to a location where a solar collector could be installed". There are four distinct types or levels of solar access in accordance with the location of an installation, (Fig. 3) as follows:-



LEVELS OF SOLAR ACCESS PROTECTION



EFFECT OF SOLAR ACCESS PROTECTION ON HOUSING DENSITY

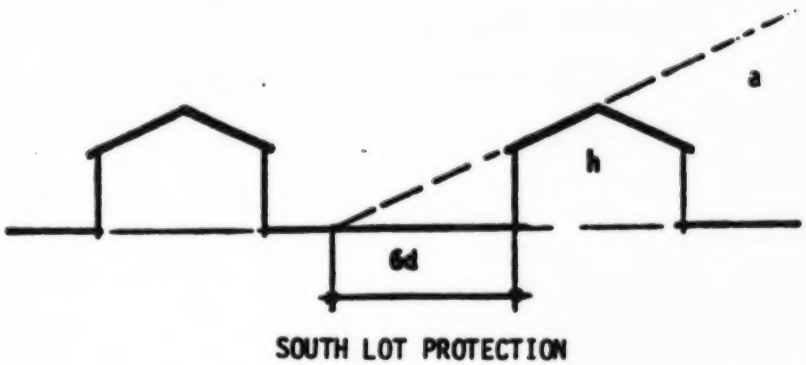


Fig. 3: OPTIONS or LEVELS in SOLAR ACCESS PROTECTION

i) ROOFTOP SOLAR ACCESS PROTECTION: This is the simplest and least controversial type of access, because in a residential area of say, two-storey houses, the possibility of conflict between adjacent homes obscuring each other's rooftop solar collectors is minimal.

ii) SOUTH WALL SOLAR ACCESS PROTECTION: This may necessitate lower residential densities, or specially designed roof and house shapes to protect the solar access space available to a neighbouring house.

iii) SOLAR ACCESS PROTECTION FOR PARTS OF A LOT allows the installation of solar collectors at ground level. This is obviously a more stringent requirement as the safeguarding of access space all the way to the ground surrounding a neighbour's house, necessitates a large lot, a distant position and perhaps even a special roof or building shape for a house. All these requirements obviously spell more dollars and cents for a house.

iv) SOLAR ACCESS PROTECTION FOR ACCESSORY BUILDINGS allows the installation of solar collectors on garages and other outbuildings. This may appear to be less important until one considers greenhouses, which may become an important source of fresh food for a household in the future, as food becomes increasingly more expensive.

The type of solar access to be protected may have to vary for each part of the City in accordance with the following factors:

a. Depth of street blocks;

b. The number of mature trees on public and private land;

c. Direction of street - e.g. east to west;

d. Residential density, as affected by the relative height of adjacent buildings;

e. The spacing of buildings;

f. The age and architectural style of buildings producing a geometry of shapes which may facilitate or hinder sunlight penetration;

g. Local topography - e.g. sudden differences in height of the ground, valleys, hills, etc.

h. Local community feeling and interest in solar access protection.

Factors (a) to (g) were considered on a preliminary basis prior to working sessions with local technical committees, in order to carry out trial applications of solar access protection for the areas of Glebe, Westboro and Ottawa South (see 6.0 below). The last factor (h) is considered to be the most important one however, and this entire study is meant to help initiate action at community level, in order to ensure that it is fully considered before any action is taken.

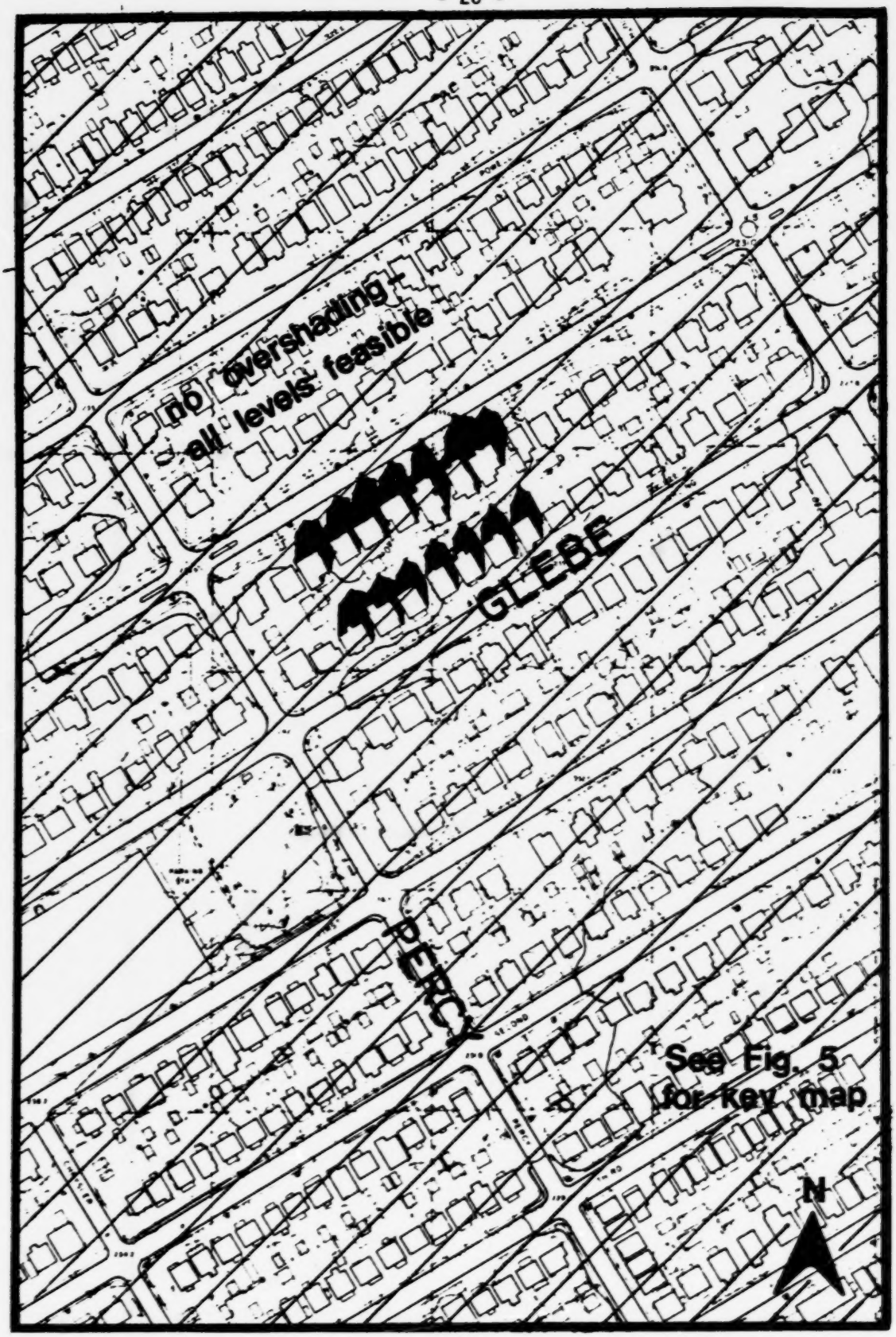
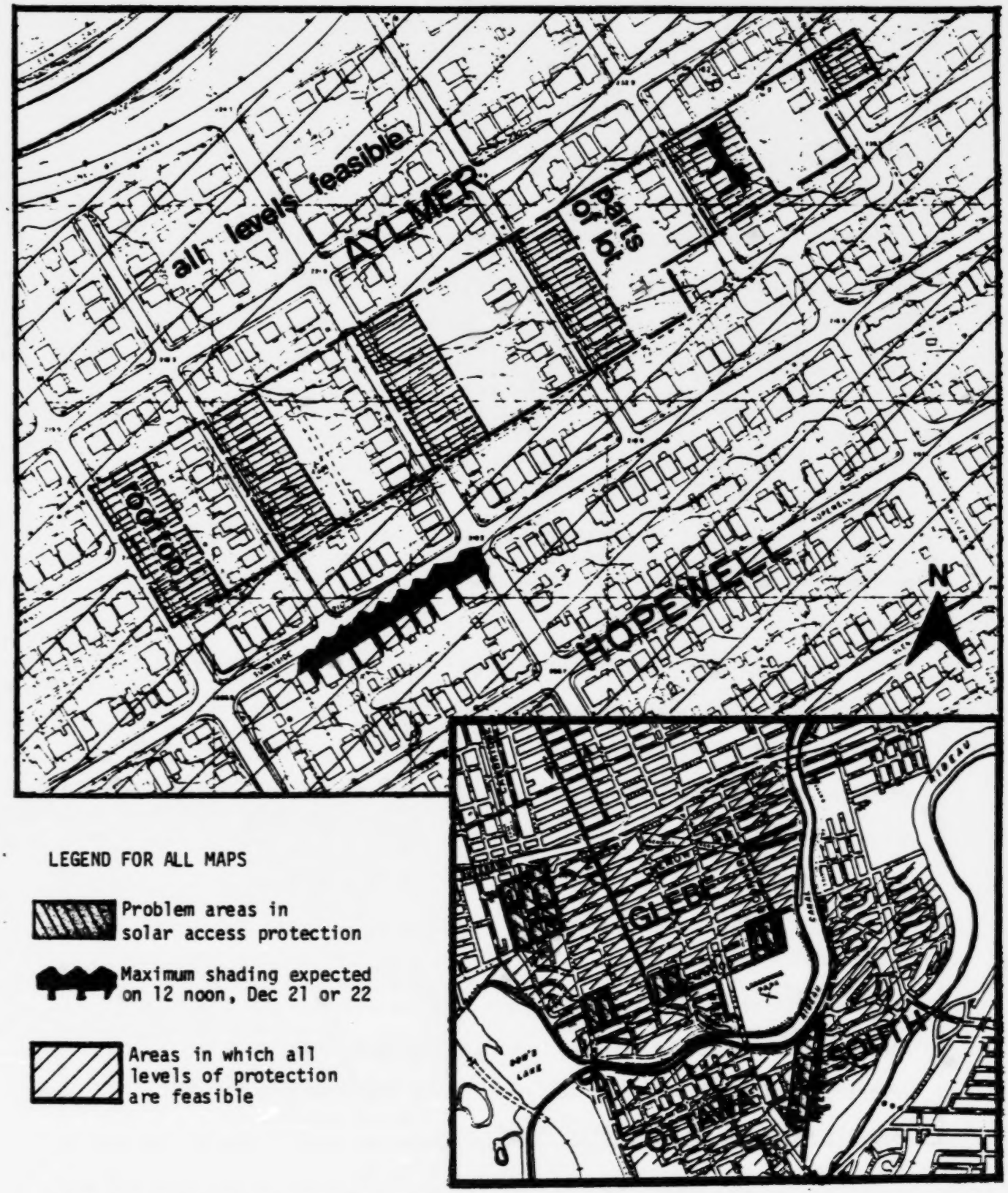


Fig. 4: POSSIBLE SOLAR ACCESS PROTECTION FOR PART OF THE GLEBE.



LEGEND FOR ALL MAPS

Problem areas in solar access protection

Maximum shading expected on 12 noon, Dec 21 or 22

Areas in which all levels of protection are feasible

Fig. 5: POSSIBLE SOLAR ACCESS PROTECTION FOR PARTS OF OTTAWA SOUTH.

6.0 Trial Application

In relation to the three districts forming the immediate focus of this study, it may be said that the depth of most street blocks in the Glebe and Ottawa South, coupled with the direction of residential streets and building spacing, allow all types of Solar Access Protection (Figs. 4 and 5). In certain areas in which lots are smaller and streets run north-to-south, however, the only feasible protection may be Rooftop. Ottawa South presents the least number of problem areas in this respect.

In Westboro the picture is far from clear, because there is a number of 30'x60' sub-standard lots and the predominant direction of streets is northerly (Fig. 6). Experiments with the heliodon of Carleton University's School of Architecture will have to be relied upon to reach some recommendations, should the community itself opt in favour of solar access protection. Part of such protection as regards future development in these and other areas of the city, may be the recommendation to vary side yards to favour the sun-facing façades of buildings, or to stagger buildings (Fig. 7).

7.0 The indirect benefits of solar access protection

The direct benefits of solar access were demonstrated in 4.0, in terms of financial savings to the building owner and the reduced reliance on imported oil for the community at large. There are also some indirect benefits which may be enumerated as follows:

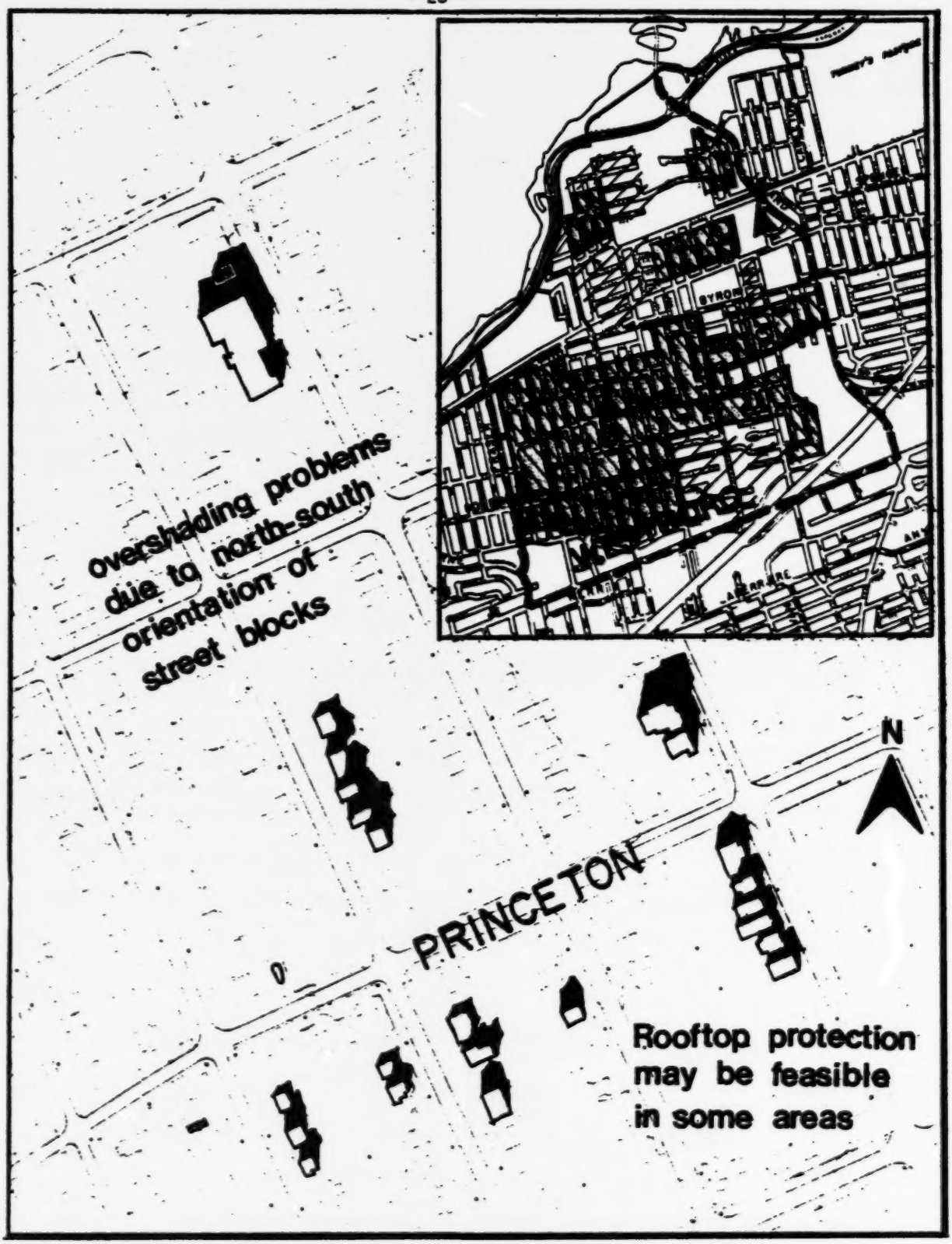

overshading problems due to north-south orientation of street blocks
PRINCETON
N
Rooftop protection may be feasible in some areas

Fig. 6: PARTS OF WESTBORO PRESENTING PROBLEMS IN SOLAR ACCESS PROTECTION.

1. Energy conservation over the long term, by virtue of the fact that solar access protection could affect:
   i. The spacing, height and shape of buildings - hence the intensity of land use in an area, which is highly relevant to energy consumption;
   ii. The choice of residential building types, by virtue of the fact that it favours multi-family dwellings, townhouses, row houses and juxtaposed dwelling types in general. By contrast, single housing units which have to be spaced widely apart to protect solar access, will tend to become increasingly more expensive, because they shall require larger lots. The choice of building type affects crucially the energy consumption for heating, as illustrated in Fig. 8.
   iii. Speed and ease of transportation by virtue of the effect on building density.

2. Employment growth and diversification by virtue of the encouragement it provides for a growing technology. Ottawa is particularly suited for solar technology industries in view of the existing labour pool in research and high technology.

3. Stimulus to architects and designers towards a creative, science-based style of architecture and building technology;

4. More variety in the urban scene by virtue of new shapes, innovative styles and novel materials coming into use to meet our needs;

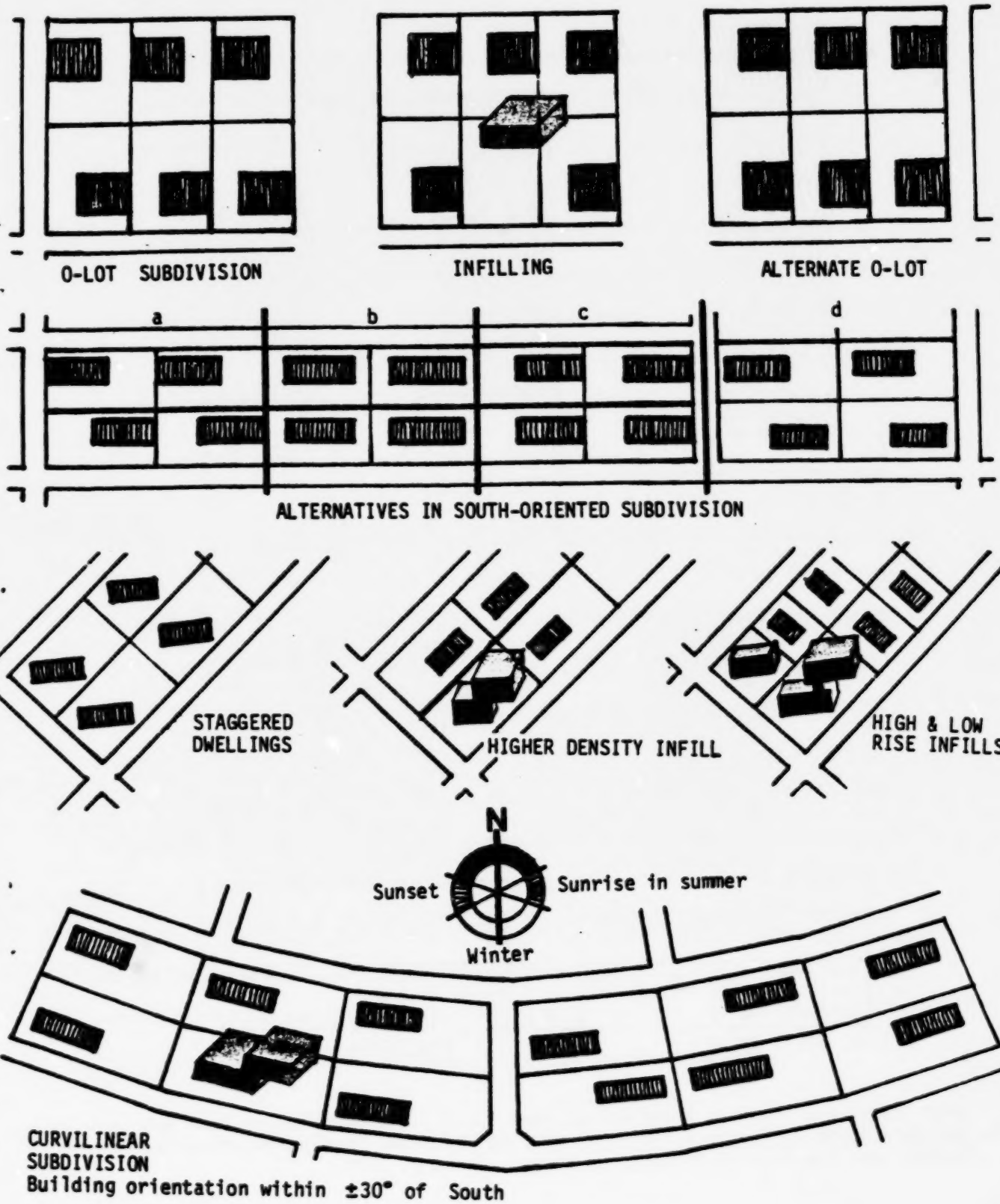
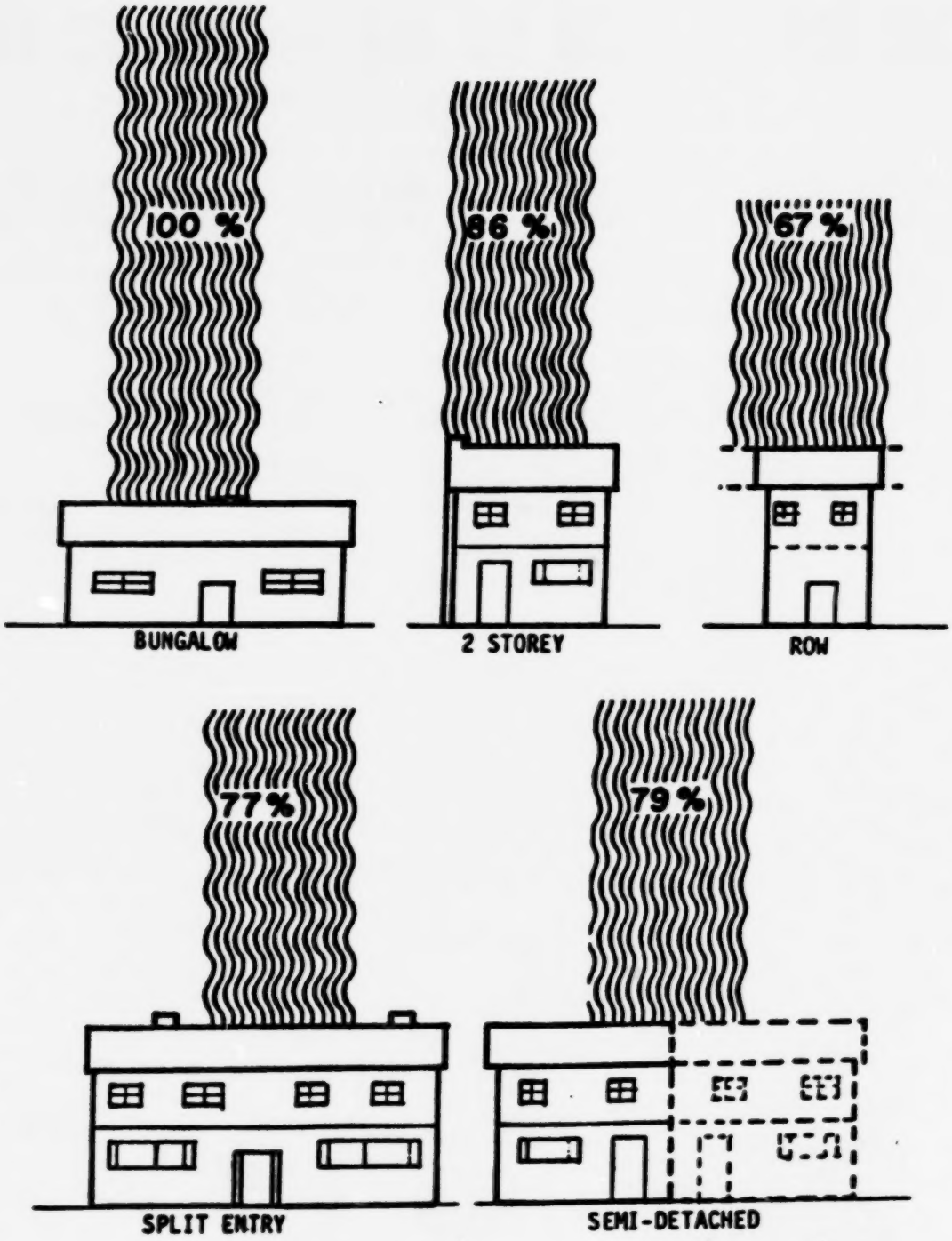


Fig. 7: LAYOUTS FAVOURING SOLAR ACCESS IN NEW HOUSING DEVELOPMENT.



NOTE: Heat losses are shown as a percent of heat loss of the bungalow of same habitable area.
SOURCE: Builders Guide to Energy Efficiency, Housing and Urban Development Association of Canada, and the Ontario Ministry of Energy, January, 1980.

Fig. 8: RELATIVE HEAT LOSS BY DWELLING TYPE

5. Sense of fair play in the distribution of opportunities to avail oneself of a ubiquitous source of energy, on the basis of land ownership.

Some of these may be debatable as benefits and there are certainly some counter-arguments to be made in Part E of this study. Suffice it to say that the purpose here is to stimulate public debate on the issue, rather than arrive at definitive conclusions one way or the other.

8.0 Legal implementation of solar access protection

Existing law in Ontario does not protect solar access and agreements between neighbours in writing to respect each other's solar access space could be legally complex and expensive. A Ministry of Energy publication titled PERSPECTIVES ON ACCESS TO SUNLIGHT (1980) explored all potential legal mechanisms - private agreement, doctrine of ancient lights, restrictive convenant, purchase of solar corridor air space, etc - and concluded that SOLAR ACCESS ZONING could become the least cumbersome and principal long-term instrument for such protection. Under this novel type of zoning, municipalities would define the extent of areas in which various sets of restrictions would be imposed on building development, signs and planting in order to encourage property owners in these areas to utilize solar energy, through passive or active solar systems for residential, industrial or commercial purposes - i.e. to become solar users.

The simplest way of incorporating solar access zoning in the Official Plan of a municipality would be through the inclusion of general statements to overlay existing zones with requirements affecting building height, bulk, location, setbacks, landscaping, lot dimensions, density and in some cases, land use. Site Plan Control could easily enforce all these requirements, once they had been stipulated in a zoning By-law and a building permit. The advantage of this method is that existing zoning and property values are accepted and only small portions of appropriate zones may have to be given an additional solar classification. The assumption throughout such an Official Plan Amendment is that different degrees of encouragement may be provided to solar users in various areas, in accordance with relevant factors, as for example, existing vegetation, architectural heritage, local traditions and community feeling. Thus, the advantages of 'SOLAR ACCESS ZONING' through an Official Plan Amendment may be summarized as follows:

1. Simple and timely: Builders and potential solar users are given assurance of their 'right to light' to facilitate their decision to 'go solar'. This assurance may also facilitate finance borrowing from banks, CMHC and other institutions.

2. Clear, comprehensible and easy to administer because zoning is widely understood and respected.

3. Promotes understanding between neighbours about respective rights-common to all in a neighbourhood - making it possible to ascertain impacts in order to plan the location and area coverage of solar collectors.

4. Easy to terminate. Following an experimental period, solar access zoning could be rescinded without permanently freezing land use.

5. Flexible in accommodating itself to local circumstances and to technological change. Novel types of solar collectors for example may have different access requirements. It can also accommodate itself to new as well as retrofit installations of solar equipment, high as well as low building density areas, etc.

6. Fair in imposing restrictions and responsibilities to all property owners in an area, for their own benefit, should they wish to take the opportunity.

7. Equitable in distributing the costs and benefits of solar access to all property tax-payers without impairing private or municipal budgets and without necessitating compensation for restrictions which, in these times and circumstances, appear to be reasonable.

These advantages should not conceal the fact that Solar Access Zoning - like any other type of regulation - imposes new responsibilities as well as creating new opportunities for the citizen. After a period of trial application in selected areas, the Council should reserve the right to modify this zoning in the light of comments received from the public.

E. THE CASE AGAINST SOLAR ACCESS PROTECTION

1.0 Scope

The case against protecting access of the sun to buildings and preserving the status quo as regards zoning on this matter, consists of social, political, economic, environmental and legal arguments. Citizens and elected representatives should consider and extend these arguments in terms of possible impact on their own circumstances, before reaching a decision on this controversial matter.

2.0 Social objections

The direction of solar access in relation to a group of buildings in an area, tends to favour those placed south, south east or south west (in the northern hemisphere). It is the north-located buildings in an area which should therefore have solar access protection by being allowed to rise higher. Blanket zoning may not be the answer and if imposed at this premature stage it will simply give rise to disputes and spoil relations between good neighbours.

3.0 Political objections

It may also be argued that as the distribution of land at present is far from equitable, the protection of solar access will only serve to compound

and perpetuate existing inequities. Square or near-square lots will have a smaller periphery with solar access protection than rectangular and linear lots - e.g. riverside walks. Should private and public properties have equal solar access protection? Could this "protection" be exploited by an extreme left or right wing regime, or financially pressed tier of government to extract more taxes from property owners?

4.0 Economic objections

The protection of solar access will tend to seriously curtail the space available for extensions in the courtilege and particularly above existing buildings. This will mean a drastic reduction of development in existing built-up areas, with dire consequences to the building industry and corresponding prospects of employment. Unwittingly, we shall have reduced the potential for higher density in the very areas which energy conservation and existing infrastructure would indicate as being most desirable. The stimulation of solar technology by solar access protection may turn out to be a 'pie in the sky', because it will be new buildings rather than refrofits that will truly enhance the prospects for the production of solar technology products. A well-conceived new solar home for example, may accommodate up to 1500 square feet of collectors while a retrofit on an existing home could take little more than 300 square feet.

5.0 Environmental objections

The most deplorable effects of solar access protection are likely to be seen in our physical environment, because it will not be only the buildings but also the trees that will be affected for the sake of solar collectors.

Buildings of traditional and time-honoured styles for example, will be retrofitted with shapes and materials of a rather incongruent technology, requiring extensive flat and shiny surfaces, which may or may not produce an acceptable contrast let alone a harmonious whole with existing architecture. It would not be too far-fetched to claim also that the extensive glass surfaces will be most vulnerable to vandalism and the expense of replacing a solar collector being high, people will have to bear with the vandalized appearance of these contraptions for some time. Once more, only in a well-conceived new house could this problem be properly overcome through design and reliance on height, shape and distance.

As regards the treatment of existing trees in a built-up area enjoying the benefits of solar access protection, suffice it to quote here the by-law passed by an American city in this respect:

> "A non-conforming portion of a tree, which casts a shadow on a solar collector in violation of the regulations (on solar access protection), may remain and be allowed to grow for as long as a living portion of the tree continues to shade the collector on each December 21, if it is found that according to the best available evidence, the tree cast a shadow on the solar collector site on December 21 of the year in which the collector was installed in the subject location."

This 'merciful' approach to trees is not likely to be extended to newly planted vegetation. Extreme measures like these, could seriously alter the urban scene in Ottawa's existing areas - particularly the Glebe - where a balance between the natural and built-up elements has been established after long decades of perseverence in planting and re-planting.

6.0 Legal counter-arguments

The quoted sample of solar access protection ordinance demonstrates the probable complexity of zoning regulations for such protection. There is irrefutable evidence that restrictions imposed by law, however well-intended at the time of conception, have inevitably given rise to litigation and bitterness. As regards development control, there is much to be said for reducing the complexity of present regulations and streamlining current approval procedures to speed up the development process. The slow pace of development is seriously affecting economic growth and it is surely a paradox that approval procedures take longer and longer, while technology is providing the tools to speed up building operations.

The difficulty of integrating solar collectors with traditional building shapes is likely to give rise to many disputes between designers and development control officers. Even if they agree, local review boards on architectural or planning control may be less prepared to accept the more extreme samples of this hybrid architecture of retrofit solar on traditional. The approval procedure is therefore bound to take longer, be more litigious and more frustrating for all parties concerned.

In view of the arguments presented in the case against solar access protection, the safest way to apply solar access zoning would be in areas of new housing, new building and new development in general. After an experimental period of application, it could be extended to more controversial areas of traditional building and long-established communities as for example, the Glebe, Ottawa South and Westboro.

E. CONCLUSION

The benefits of solar energy and the arguments in favour of protecting access to allow the largest possible number of households to avail themselves of this energy are no doubt powerful. On the other hand, if the Council considers the various impacts of solar access protection and judges them to be too high a price to pay for the added privilege of protection at the present stage of the city's development, then the citizens of Ottawa will at least have the satisfaction that the matter of solar access protection has been fully considered, but for the time being dismissed as a pressing need. In either case, this report will have served a purpose.

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